

defined above. The question cannot be discussed on the present occasion, but it is well to bear in mind that however completely the *causes* of evolution in the past may evade our attempts at demonstrative proof, the *history* of evolution is a subject which can be brought to the test. For many years it has seemed to the writer that palæontology can settle decisively whether evolution has been continuous or discontinuous. Those who desire to bring conclusive evidence to bear upon this important controversy would do well to follow the example of Prof. W. B. Scott, of Princeton, who told us at Cambridge that he was "just crazy" over the fossil mammals of Patagonia.

In the last chapter, on adaptive variations, the author would have done well to place in the forefront the warning that a superficially apparent example "of direct adaptation to surroundings in the ordinary acceptance of the term . . . may be the calling up, in response to one of two stimuli, of one of two groups of characters long since acquired by the plant protoplasm." The principle contained in these words should be prominently before the mind of the naturalist who attempts to investigate the response of an organism to its environment. He should remember that the species which he investigates are "heirs of all the ages," thoroughly inured to experimental research, past masters in the art of meeting by adaptive response the infinite variety of stimulus provided by the environment. If he remember this he will always be on his guard against a too hasty interpretation based upon the fundamental properties of protoplasm.

The discussion of the question, are acquired characters inherited? (pp. 351 *et seq.*) is a particularly interesting and suggestive introduction to the subject. A few well chosen examples of the evidence chiefly appealed to in support of such transmission are followed by a brief but well balanced discussion. The author supports the conclusion that the soma, and through the soma the environment, exert a chemical influence upon the germ-cells, and he makes effective use of the "internal secretions" which have marked an epoch in physiological research.

Several examples, generally believed to supply evidence of the "cumulative action of conditions of life" (pp. 352 *et seq.*), would be more satisfactory and convincing if they were re-investigated as a piece of special research. Too often they bear the impress of an off-hand opinion without any secure foundation upon specially directed inquiry. Thus, in the transport of adult sheep or dogs to a different climate, it may be expected that less change will be manifest in the hairy covering of the parent than in that of the offspring which has been born and passed the whole of its life in the new conditions. Thus the appearance, but by no means necessarily the reality, of an accumulated effect may be produced. In order to test the hypothesis of accumulation, it would be necessary to neglect the generation which has been subjected to two very different environments and to determine quantitatively with all possible accuracy the characters of those which follow. The often repeated statements about the telegonic effect of mating "Lord Moreton's mare"

with a male quagga, when compared with the results of Prof. Cossar Ewart's researches, prepare us for the belief that many a general impression which has been produced as evidence will collapse when it has become the subject of searching and critical investigation.

In the preface the author speaks with some diffidence of the prominence given to his own researches. Investigations such as those into the effect upon offspring of the relative freshness or staleness of the parental germ-cells would, in any circumstances, be an unfortunate omission from a book on variation. They are, moreover, described in the publications of scientific societies not always freely accessible to the general reader. For another reason also the book would have suffered if these researches had been treated less fully. When the author of a general work is not altogether wanting in the sense of fitness and proportion, the account of his own contributions to science will probably be the salt of his book. These subjects stirred his own enthusiasm for research, and in writing of them he is likely to stir the enthusiasm of others.

E. B. P.

MATHEMATICAL THEORY OF ECLIPSES.

The Mathematical Theory of Eclipses, according to Chauvenet's Transformation of Bessel's Method. Explained and illustrated by Roberdeau Buchanan, S.B. Pp. x+247. (Philadelphia and London: J. B. Lippincott Co., 1904.) Price 31s. net.

WHEN a practical man devotes himself to the task of explaining to others the difficulties of any specialised subject on which he has been engaged for many years, the result is likely to be satisfactory. There is always the chance that the prolonged study of one particular subject has had the effect of unduly exalting its importance, with the consequent loss of a proper perspective, and when one sees a comparatively narrow branch of astronomical inquiry, like eclipses, occupying a rather ponderous volume, he may be led to think that the subject has been indiscreetly expanded. We therefore hasten to say that there is no evidence of disproportionate treatment in Mr. Buchanan's book. He himself has been employed for twenty-three years in the office of the "American Ephemeris and Nautical Almanac," and during that time has been responsible for the accurate preparation of the necessary information connected with eclipse prediction. His practical acquaintance with the subject eminently fits him for the task he has undertaken, and his book is a success. The moon's nodes have made more than one complete revolution since he began his work, and an entire series of eclipses has revealed to him their peculiarities and oddities.

The theory of eclipses has been well explained by various astronomers, and practical rules given by some. Hallaschka, in his "Elementa Eclipsium," following the method of orthographic projection, has worked out an example in full. Woolhouse, in the appendix to the "Nautical Almanac" for 1836, not only discussed the subject with great fulness, but gave practical rules for the determination of the phenomena, which for many years were followed in

the preparation of the English ephemeris, and perhaps are so still. Bessel gave a more thoroughly consecutive discussion, which Chauvenet followed in his treatise, and this last forms the basis of Mr. Buchanan's work. The practical part of the arrangement does not seem to be easily systematised. A computer finds some difficulty in translating the formulæ into numbers. There are to the uninitiated continual ambiguities about the quadrants; and the manner in which angles are to be reckoned is frequently a stumbling block to the unwary. Perhaps these little difficulties are more noticeable in Woolhouse's method than in Bessel's, but it is with the view of limiting these troubles and of giving a convenient arrangement to the whole of the work that Mr. Buchanan has written his book. In his time he must have met with all the difficulties with which a young computer has to contend, and must have removed these out of the path of many. Knowing these pitfalls, he has done his best to get rid of them by suitable explanations, and probably with success. But those who have conducted pupils through carefully worked examples know only too well that a fresh set of difficulties is apt to reappear with a new case.

The author has divided his book into two parts. In the first he treats of solar eclipses and the method of deriving the various curves which are necessary for the exhibition of the whole circumstances of the phenomenon on a map. Here we get the north and south limits of total and partial eclipses, the position where the eclipse begins and ends with the sun in the horizon, and one can follow the method by which are drawn those weird curves on the eclipse maps that accompany every nautical ephemeris. By way of adding a little lightness to a rather dreary subject, we may notice some curiosities the explanation of which is not very readily seen without the assistance of a competent guide, such as the occurrence of a north limiting curve of totality falling south of the south limiting curve. Ingenuity might construct some further troublesome problems of this nature when the clue is furnished, and one can imagine an examiner exulting over the discovery of such oddities, affording as they do opportunity for worrying unhappy candidates who fall into his hands.

In the second part of the book we have detailed the method of computing the circumstances of lunar eclipses, occultations of stars by the moon, and of the transits of Venus and Mercury. These are practically particular cases of the same problem as that treated in the first part, simplified by certain conditions. In the case of the lunar eclipse, the absolute position of the moon and shadow are independent of the position of the observer on the earth, and therefore the effects of parallax can be treated much more simply. We notice that the semi-diameter of the shadow is increased by the fiftieth part of its amount, in preference to the older estimate of $1/60$, but the whole question of semi-diameters is a troublesome one, which will soon have to be treated with great rigour. The occultation semi-diameter is not altogether satisfactory, and some international convention is needed to secure uniformity. From a letter from Dr.

Downing, quoted by the author, we gather that the occultation diameter of the moon, as used in the preparation of the English "Nautical Almanac," differs $2''.36$ from that employed in eclipse calculations. But we find a little difficulty in following the author in his reference to authorities. In the matter of lunar parallax, Adams is not quoted, and Lardner's "Handbook of Astronomy," or Proctor on "The Moon," can scarcely be considered original and trustworthy sources.
W. E. P.

ENGLISH FIELD-BOTANY.

Flora of Hampshire, including the Isle of Wight. By Frederick Townsend, M.A., F.L.S. Second edition. Pp. xxxviii + 658. (London: Lovell Reeve and Co., Ltd., 1904.) Price 21s. net.

ENGLISH field botanists frequently complain that the British flora has not yet received the careful critical attention which has been lavished on Continental floras. To a certain extent this is doubtless true. We have no manual that for thoroughness of treatment and wealth of reference to original descriptions and type-specimens can compare with Rouy and Foucault's "Flore de France"; at the same time there is an abundance of valuable information scattered through our numerous natural history journals only waiting for some energetic and widely experienced systematist to collate and bring together in a really satisfactory British flora. There are several botanists eminently fitted for such an undertaking, and it is urgently to be desired that one or more of them should take the matter in hand. Meanwhile, our numerous and rapidly accumulating county floras are paving the way to a complete botanical survey of the British Isles.

In Mr. Townsend's "Flora of Hampshire and the Isle of Wight" we have one of the best books of its class, and the work and careful attention expended upon its production must have been very considerable. The volume opens with a chapter on topography and climate. This is followed by an account of the geological structure of the district, including a summary of Mr. Clement Reid's researches on the fossil seeds of the Stone and Silchester beds of the newer Tertiary formation. In his list it is particularly interesting to notice the names of several plants usually regarded as weeds of cultivation, or as colonists, such as *Brassica alba*, Boiss., *Thlaspi arvense*, L., *Linum usitatissimum*, Linn., and also damson and plum.

The now generally approved method of dividing a district into botanical areas according to its river-systems is here in the main followed, and a useful map of the county is appended. Turning to the systematic section by far the larger portion of the book—so many points call for attention that it is quite impossible within the limits of a short notice to mention more than a few of them. In the section devoted to *Ranunculus*, what appears to be a satisfactory account of the forms of *R. acris* is given; this will be appreciated by many collectors. The name *Nymphaea alba*, Linn., is retained instead of *Castalia speciosa*,